HIQ PM-3-E-D-CT

Din Rail Power Sensor for Single and Three Phase Electrical Systems

- Measures kWh Kvarh, KW, Kvar, KVA, P,
- F, PF, Hz, dmd, V, A, THD,etc.
- Bi-directional measurement IMP & EXP
- Two pulse outputs
- RS485 Modbus
- Din rail mounting 35mm
- 0.33V CT connection
- Better than Class 1 / B accuracy

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1. Introduction

This document provides operating, maintenance and installation instructions. The unit measures and displays the characteristics of three phase four wires(3p4w) supplies, including voltage, frequency, current, power, active and reactive energy, imported or exported. Energy is measured in terms of kWh, kVArh. Maximum demand current can be measured over preset periods of up to 60minutes. In order to measure energy, the unit requires voltage and current inputs in addition to the supply required to power the product. The requisite current input(s) are obtained via current transformers (CT).

This power sensor can be configured to work with a wide range of CTs with 0.33V output, giving the unit a wide range of operation. Built-in interfaces provide pulse and RS485 Modbus RTU outputs. Configuration is password protected.

This unit can be powered from a separate auxiliary (AC or DC) supply. Alternatively, it can be powered from the monitored supply, where appropriate.

1.1 Unit Characteristics
The Unit can measure and display:
- Line voltage and THD% (total harmonic distortion) of all phases
- Line Frequency
- Currents, Current demands and current THD% of all phases
- Power, maximum power demand and power factor
- Active energy imported and exported
- Reactive energy imported and exported

The unit has password-protected set-up screens for:
- Changing password
- Demand Interval time
- Reset demand measurements
- Pulse output duration

Two pulse output indicates real-time energy measurement. An RS485 output allows remote monitoring from another display or a computer.

1.2 Current Transformer Primary Current
The unit can be configured to operate with CT with 0.333V output. The secondary CT is fixed at 0.333V, and the primary is optional.

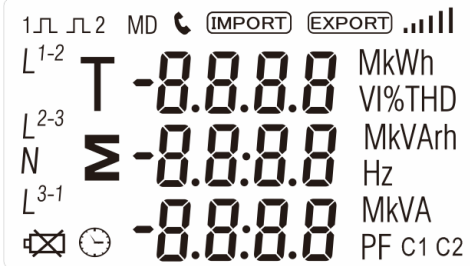### 1.3 RS485 Serial – Modbus RTU
This uses an RS485 serial port with Modbus RTU protocol to provide a means of remotely monitoring and controlling the Unit
Set-up screens are provided for setting up the RS485 port. Refers to section 4

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1.4 Pulse output

This provides two pulse outputs that clock up measured active and reactive energy. The constant for reactive energy is 3200imp/kVArh. The pulse width for active energy can be set from the set-up menu.

2. Start Up Screens

1⌁ ⌁2 MD 📞 (IMPORT) (EXPORT) .₁₁⣿ L 1-2 T -8.8.8.8 MkWh VI%THD L 2-3 N Σ -8.8:8.8 MkVArh Hz L 3-1 🗵 🕒 -8.8:8.8 MkVA PF C1 C2	The first screen lights up all display segments and can be used as a display check.
SoFt 1.320 2014	The second screen indicates the firmware installed in the unit and its build number.
INSt tESt PASS	The interface performs a self-test and indicates the result if the test passes.

After a short delay, the screen will display active energy measurements.

3. Measurements

The buttons operate as follows:

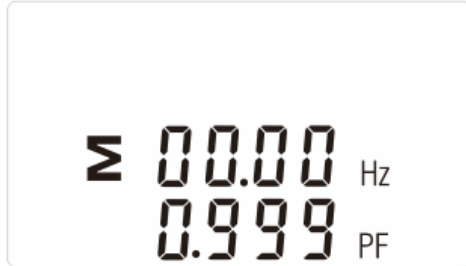|	
U/I ◄ ESC	Selects the Voltage and Current display screens In Set-up Mode, this is the "Left" or "Back" button.
M ▲	Select the Frequency and Power factor display screens In Set-up Mode, this is the "Up" button
P ▼	Select the Power display screens In Set-up Mode, this is the "Down" button
E ►↵	Select the Energy display screens In Set-up mode, this is the "Enter" or "Right" button

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3.1 Voltage and Current

Each successive pressing of the [M ▲] button selects a new range:

L¹ 000.0 L² 000.0 V L³ 000.0	Phase to neutral voltages
L¹ 0.000 L² 0.000 A L³ 0.000	Current on each phase
L¹ 00.00 V %THD L² 00.00 L³ 00.00	Phase to neutral voltage THD%
L¹ 00.00 I%THD L² 00.00 L³ 00.00	Current THD% for each phase

3.2 Frequency and Power factor and Demand

Each successive pressing of the [M ▲] button selects a new range:

Σ 00.00 Hz 0.999 PF	Frequency and Power Factor (total)

L¹ 0.999 L² 0.999 L³ 0.999 PF	Power Factor of each phase
MD ` 0.000 kW Σ	Maximum Power Demand
MD L¹ 0.000 L² 0.000 A L³ 0.000	Maximum Current Demand

3.3 Power

Each successive pressing of the [P ▼] button select a new range:

L¹ 0.000 kW L² 0.000 L³ 0.000	Instantaneous Active Power in kW
L¹ 0.000 L² 0.000 kVAr L³ 0.000	Instantaneous Reactive Power in kVAr

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L^1 0.000 L^2 0.000 L^3 0.000 kVA	Instantaneous Volt-amps in KVA
0.000 kW **M** 0.000 kVAr 0.000 kVA	Total kW, kVArh, kVA

3.4 Energy Measurements

Each successive pressing of the [E] button selects a new range:

(IMPORT) 0.000 kWh 031.4	Imported active energy in kWh
(EXPORT) 0000 kWh 000.0	Exported active energy in kWh
(IMPORT) 0000 000.0 kVArh	Imported reactive energy in kVArh

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EXPORT 0000 000.0　kVArh	Exported reactive energy in kVArh
0000　kWh Σ 0 3 1.4	Total active energy in kWh
0000 Σ 000.0　kVArh	Total reactive energy in kVAh

4. Setting Up

To enter set-up mode, pressing the [E ►↵] button for 3 seconds, until the password screen appears.

PASS

0000
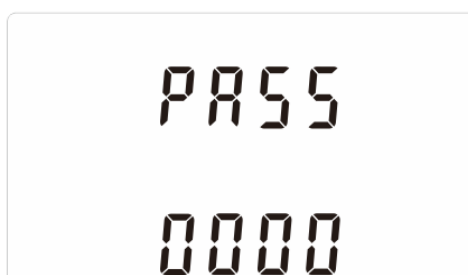
Setting up is password-protected so you must enter the correct password (default '1000') before processing. If an incorrect password is entered, the display will show: PASS   Err

PASS

Err

To exit setting-up mode, press [U/I ◄ BSC] repeatedly until the measurement screen is restored.

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4.1 Set-up Entry Methods

Some menu items, such as password and CT, require a four-digit number entry while others, such as supply system, require selection from a number of menu options.

4.1.1 Menu Option Selection

1) Use the [M▲] and [P▼] buttons to select the required item from the menu. selection does not roll over between bottom and top of list

2) Press [E▶] to confirm your selection

3) If an item flashes, then it can be adjusted by the [M▲] and [P▼] buttons. If not, there maybe a further layer.

4) Having selected an option from the current layer, press [E▶] to confirm your selection. The SET indicator will appear.

5) Having completed a parameter setting, press [U/I◀ESC] to return to a higher menu level. The SET indicator will be removed and you will be able to use the [M▲] and [P▼] buttons for further menu selection.

6) On completion of all setting-up, press [U/I◀ESC] repeatedly until the measurement screen is restored.

4.1.2 Number Entry Procedure

When Setting up the unit, some screens require the entering of a number. In particular, on entry to the setting up section, a password must be entered. Digits are set individually, from left to right. The procedure is as follows:

1) The current digit to be set flashes and is set using the [M▲] and [P▼] buttons

2) Press [E▶] to confirm each digit setting. The SET indicator appears after the last digit has been set.

3) After setting the last digit, press [U/I◀ESC] to exit the number setting routine. The SET indicator will be removed.

4.2 Change password

SEt PASS 1000	Use the [M ▲] and [P ▼] to choose the change password option
SEt PASS **1**000	Press the [E ▶↵] to enter the change password routine. The new password screen will appear with the first digit flashing
SEt PASS 1**0**00	Use [M ▲] and [P ▼] to set the first digit and press [E ▶↵] to confirm your selection. The next digit will flash.
SEt PASS 1100	Repeat the procedure for the remaining three digits
SEt PASS 1100	After setting the last digit, SET will show.
Press [U/I ◀ ESC] to exit the number setting routine and return to the Set-up menu.	

4.3 DIT Demand Integration Time

This sets the period in minutes over which the current and power readings are integrated for maximum demand measurement. The options are: off, 5, 10, 15 30,60 minutes

SEt dIt 10	From the set-up menu, use [M ▲] and [P ▼] buttons to select the DIT option. The screen will show the currently selected integration time.
SEt dIt *10*	Press [E ▶↵] to enter the selection routine. The current time interval will flash
SEt dIt	Use [M ▲] and [P ▼] buttons to select the time required.
SEt dIt 20	Press [E ▶↵] to confirm the selection. SET indicator will appear.
Press [U/I◀ ESC] to exit the DIT selection routine and return to the menu.	

4.4 CT

The CT option sets the primary current(CT2 fixed 0.333V) of the current transformer (CT) that wires to the power sensor.

SEt Ct1 0005	From the Set-up menu, use [M ▲] and [P ▼] buttons to select the CT primary(CT1). Its' default 5A,and ranged from 0005 to 9999

![display showing SEt Ct2 0.333]	Secondary CT(CT2) It's fixed 0.333V, and can not be set.

4.5 PT

The PT option sets the secondary voltage (PT2 100 to 500V) of the Voltage transformer (PT) that wires to the power sensor.

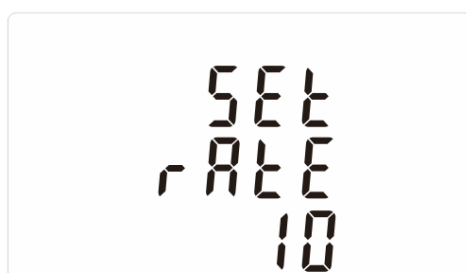|	
![display showing SEt Pt2 400]	From the Set-up menu, use [M ▲] and [P ▼] buttons to select the PT option. The screen will show the voltage PT secondary voltage value. The default value is 400V
![display showing SEt Pt2 400]	Secondary PT setting Press [E ►↵] to enter the PT secondary voltage selection routine. The range is from 100 to 500V
![display showing Pt rAtE 0001]	Set PT ratios value Press [E ►↵] to enter the PT ratio screen. The range is from 0001 to 9999
For example, if set the ratio to be 100,it means the primary voltage equals secondary voltage x100	

4.6 Pulse output

This option allows you to configure the pulse output. The output can be set to provide a pulse for a defined amount of energy active or reactive.

Use this section to set up the relay pulse output—Units: kWh, kVArh

SEt **rLY** kWh	From the Set-up menu, use [M ▲] and [P ▼] buttons to select the Pulse output option.
SEt **rLY** kWh	Press [E ►] to enter the selection routine. The unit symbol will flash.
SEt **rLY** kVArh	Use [M ▲] and [P ▼] buttons to choose kWh or kVArh.
On completion of the entry procedure, press [E ►] to confirm the setting and press [U/I ◄ ESC] to return to the main set up menu.	

4.6.1 Pulse rate

Use this to set the energy represented by each pulse. Rate can be set to 1 pulse per 0.01kWh/0.1kWh/1kWh/10kWh/100kWh.

SEt **rAtE** **10**

(It shows 1 impulse = 10kWh/kVArh)

SEt **rAtE** **10**	From the Set-up menu, use [M ▲] and [P ▼] buttons to select the Pulse Rate option.

``` SEt rAtE 10 ```	Press [E] to enter the selection routine. The current setting will flash. 0.01/0.1/1/10/100kWh/kVArh per pulse
Use [M] and [P] buttons to choose pulse rate. On Completion of the entry procedure, press [E] to confirm the setting and press [U/I ESC] to return to the main set up menu.	

4.6.2 Pulse Duration

The energy monitored can be active or reactive and the pulse width can be selected as 200, 100 or 60ms.

```
SEt
PULS
200
```
(It shows pulse width of 200ms)

``` SEt PULS 200 ```	From the Set-up menu, use [M] and [P] buttons to select the Pulse width option.
``` SEt PULS 200 ```	Press [E] to enter the selection routine. The current setting will flash.
Use [M] and [P] buttons to choose pulse width. On Completion of the entry procedure, press [E] to confirm the setting and press [U/I ESC] to return to the main set up menu.	

4.7 Communication

There is a RS485 port can be used for communication using Modbus RTU protocol. For Modbus

RTU, parameters are selected from Front panel.

4.7.1 RS485 Address

```
SEt
Addr
001
```
(The range is from 001 to 247)

```SEt Addr 001```	From the Set-up menu, use ⬛M▲ and ⬛P▼ buttons to select the Address ID
```SEt Addr 101```	Press ⬛E▶ button to enter the selection routine. The current setting will be flashing.
```SEt Addr 101```	Use ⬛M▲ and ⬛P▼ buttons to choose Modbus Address(001 to 247)
On completion of the entry procedure, press ⬛E▶ button to confirm the setting and press ⬛U/I◀ESC button to return the main set-up menu.	

4.7.2 Baud Rate

```SEt bAUd 9.6 k```	From the Set-up menu, use ⬛M▲ and ⬛P▼ buttons to select the Baud Rate option.

SEt bAUd 9.6 k	Press [E ▶] to enter the selection routine. The current setting will flash.
SEt bAUd 38.4 k	Use [M ▲] and [P ▼] buttons to choose Baud rate 2.4k. 4.8k, 9.6k, 19.2k, 38.4k

On Completion of the entry procedure, press [E ▶] to confirm the setting and press [U/I ◀ ESC] to return to the main set up menu.

4.7.3 Parity

SEt PArI EuEn	From the Set-up menu, use [M ▲] and [P ▼] buttons to select the Parity option.
SEt PArI EuEn	Press [E ▶] to enter the selection routine. The current setting will flash.
SEt PArI nonE	Use [M ▲] and [P ▼] buttons to choose Parity (EVEN / ODD / NONE)

On completion of the entry procedure, press [E] to confirm the setting and press [U/I ESC] to return to the main set up menu.	

4.7.4 Stop bits

SEt StoP 2	From the Set-up menu, use [M] and [P] buttons to select the Stop Bit option.
SEt StoP 2	Press [E] to enter the selection routine. The current setting will flash.
SEt StoP 1	Use [M] and [P] buttons to choose Stop Bit (2 or 1)
On completion of the entry procedure, press [E] to confirm the setting and press [U/I ESC] to return to the main set up menu.	

4.8 CLR

The power sensor provides a function to reset the maximum demand value of current and power.

CLr	From the Set-up menu, use [M] and [P] buttons to select the reset option.

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CLr **dIt**	Press [E] to enter the selection routine. The dIt will flash.

Press [E] to confirm the setting and press [U/I ESC] to return to the main set up menu.
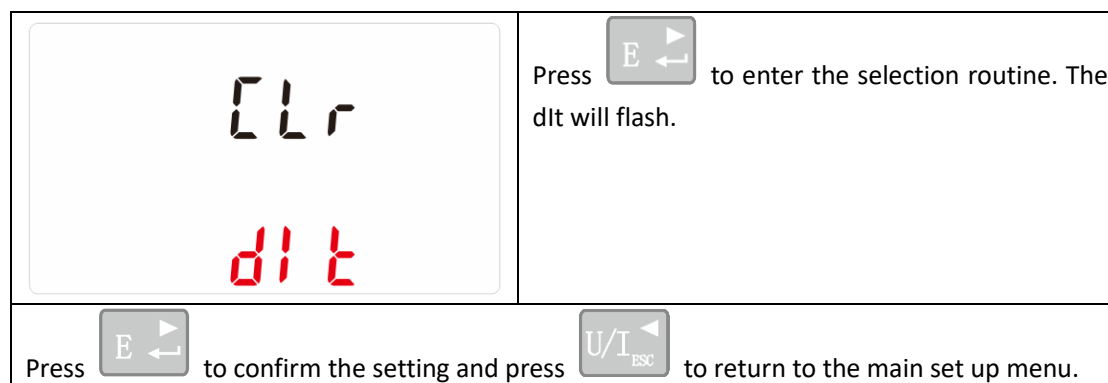
5 Specifications

5.1 Measured Parameters
The unit can monitor and display the following parameters of four phase four wire(3p4w) supply.

5.1.1 Voltage and Current
Phase to neutral voltages 100 to 289V a.c.

Voltages between phases 173 to 500V a.c.

Percentage total voltage harmonic distortion (THD%) for each phase to N

Percentage voltage THD% between phases

Current THD% for each phase

5.1.2 Power factor and Frequency and Max. Demand
Frequency in Hz

Instantaneous power:
- Power 0 to 3600 MW
- Reactive Power 0 to 3600 MVAr
- Volt-amps 0 to 3600 MVA

Maximum demanded power since last Demand reset Power factor

Maximum neutral demand current, since the last Demand reset (for three phase supplies only)

5.1.3 Energy Measurements
- Imported active energy   0 to 9999999.9 kWh
- Exported active energy   0 to 9999999.9 kWh
- Imported reactive energy   0 to 9999999.9 kVArh
- Exported reactive energy   0 to 9999999.9 kVArh
- Total active energy   0 to 9999999.9 kWh
- Total reactive energy   0 to 9999999.9 kVArh

5.2 Measured Inputs
Voltage inputs through 4-way fixed connector with 2.5mm^2 stranded wire capacity. four phase four wire(3p4w) unbalanced. Line frequency measured from L1 voltage or L3 voltage.

Three current inputs (six physical terminals) with 2.5mm^2 stranded wire capacity for connection of external CTs. Nominal rated input current 5A or 1A a.c. Rms.

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5.3 Accuracy

- Voltage   0·5% of range maximum
- Current   0·5% of nominal
- Frequency   0·2% of mid-frequency
- Power factor   1% of unity (0.01)
- Active power (W)   ±1% of range maximum
- Reactive power (VAr)   ±2% of range maximum
- Apparent power (VA)   ±1% of range maximum
- Active energy (Wh)   Class 1 IEC 62053-21
- Reactive energy (VARh)   ±2% of range maximum
- Total harmonic distortion   1% up to 31st harmonic

5.4 Auxiliary Supply

Two-way fixed connector with 2·5mm2 stranded wire capacity.

85 to 275V a.c. 50/60Hz ±10% or 120V to 380V d.c. ±20%. Consumption < 10W.

5.5 Interfaces for External Monitoring

Three interfaces are provided:

- an RS485 communication channel that can be programmed for Modbus RTU protocol
- an relay output indicating real-time measured energy.(configurable)
- an pulse output 3200imp/kWh (not configurable)

The Modbus configuration (Baud rate etc.) and the pulse relay output assignments (kW/kVArh, import/export etc.) are configured through the Set-up screens.

5.5.1 Pulse Output

The pulse output can be set to generate pulses to represent kWh or kVArh.

Rate can be set to generate 1 pulse per:

0.01 = 10 Wh/VArh

0.1 = 100 Wh/VArh

1 = 1 kWh/kVArh

10 = 10 kWh/kVArh

100 = 100 kWh/kVArh

Pulse width 200/100/60 ms.

Relay Rating 240V ac 50mA

5.5.2 RS485 Output for Modbus RTU

For Modbus RTU, the following RS485 communication parameters can be configured from the Set-up menu:

Baud rate 2400, 4800, 9600, 19200, 38400

Parity none(default)/odd/even

Stop bits 1 or 2

RS485 network address *nnn* – 3-digit number, 1 to 247

Modbus™ Word order Hi/Lo byte order is set automatically to normal or reverse. It cannot be configured from the set-up menu.

5.6 Reference Conditions of Influence Quantities

Influence Quantities are variables that affect measurement errors to a minor degree. Accuracy is verified under nominal value (within the specified tolerance) of these conditions.

- Ambient temperature   23°C ±1°C
- Input waveform   50 or 60Hz ±2%
- Input waveform   Sinusoidal (distortion factor < 0·005)
- Auxiliary supply voltage   Nominal ±1%
- Auxiliary supply frequency   Nominal ±1%
- Auxiliary supply waveform (if AC)   Sinusoidal (distortion factor < 0·05)
- Magnetic field of external origin   Terrestrial flux

5.7 Environment

- Operating temperature   -25°C to +55°C*
- Storage temperature   -40°C to +70°C*
- Relative humidity   0 to 90%, non-condensing
- Altitude   Up to 2000m
- Warm up time   1 minute
- Vibration   10Hz to 50Hz, IEC 60068-2-6, 2g
- Shock   30g in 3 planes

*Maximum operating and storage temperatures are in the context of typical daily and seasonal variation.

5.8 Mechanics
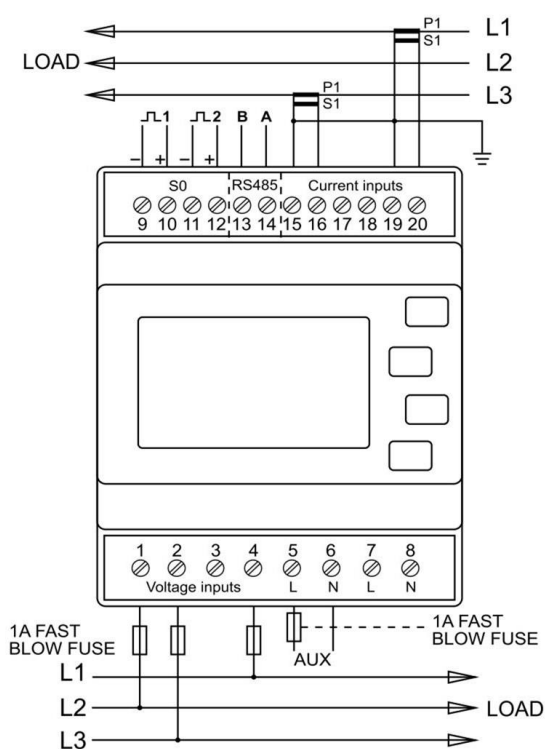
- DIN rail dimensions   72 x 94.5 mm (WxH) per DIN 43880
- Mounting   DIN rail (DIN 43880)
- Sealing   IP20 (minimum)
- Material   Self-extinguishing UL94 V_0
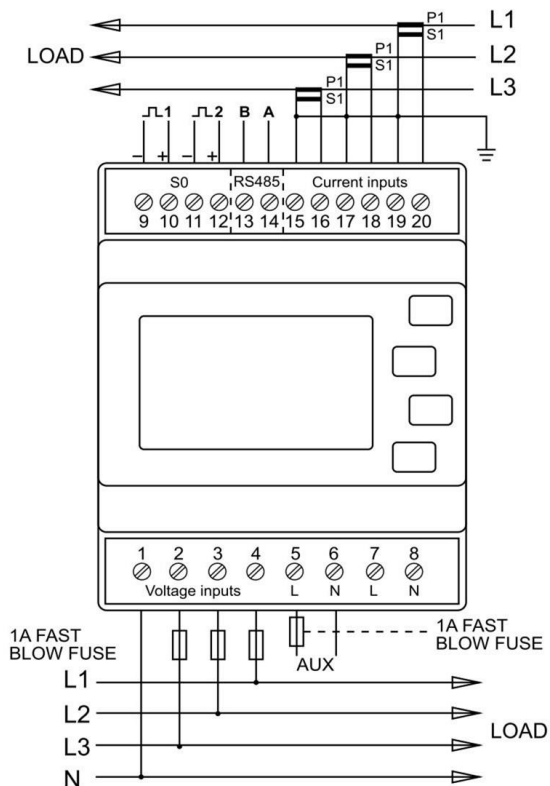
6 Dimensions
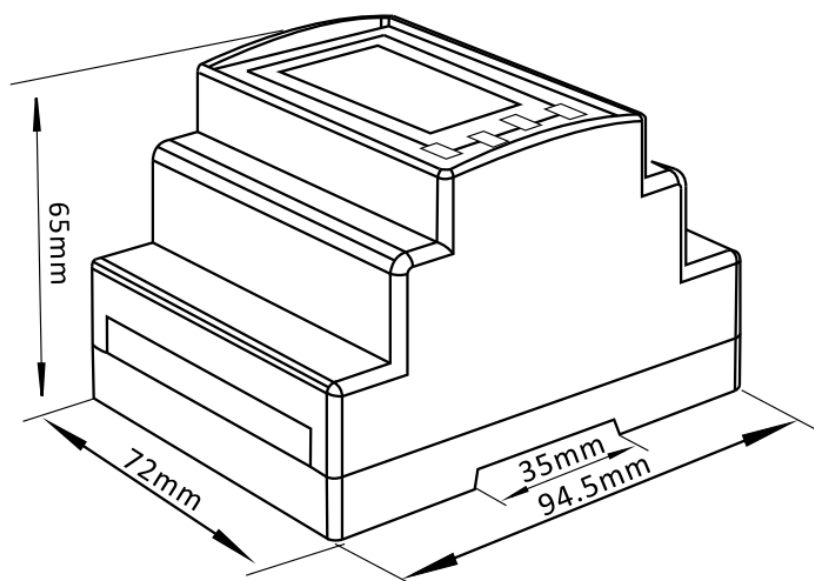
7 Installation

Three phase three wires

Three phase four wires

Single phase two wires